



[4910-13]

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Part 25

[Docket No.FAA-2013-1054; Notice No. 25-513-SC]

Special Conditions: Bombardier Inc., Models BD-500-1A10 and BD-500-1A11 series airplanes; Side Stick Controllers: Pilot Strength, Pilot Control Authority, and Pilot Control

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Final special conditions; request for comments.

SUMMARY: These special conditions are issued for the Bombardier Inc. Models BD-500-1A10 and BD-500-1A11 series airplanes. These airplanes will have a novel or unusual design feature associated with side stick controllers for pitch and roll control instead of conventional wheels and columns. The applicable airworthiness regulations do not contain adequate or appropriate safety standards for this design feature. These special conditions contain the additional safety standards that the Administrator considers necessary to establish a level of safety equivalent to that established by the existing airworthiness standards.

DATES: The effective date of these special conditions is **[insert date of publication in the *Federal Register*]**. We must receive your comments by **[insert date 45 days after date of publication in the *Federal Register*]**.

ADDRESSES: Send comments identified by docket number FAA-2013-1054 using any of the following methods:

- Federal eRegulations Portal: Go to <http://www.regulations.gov/> and follow the online instructions for sending your comments electronically.

- Mail: Send comments to Docket Operations, M-30, U.S. Department of Transportation (DOT), 1200 New Jersey Avenue, SE., Room W12-140, West Building Ground Floor, Washington, D.C., 20590-0001.
- Hand Delivery or Courier: Take comments to Docket Operations in Room W12-140 of the West Building Ground Floor at 1200 New Jersey Avenue, SE., Washington, D.C., between 9 a.m. and 5 p.m., Monday through Friday, except federal holidays.
- Fax: Fax comments to Docket Operations at 202-493-2251.

Privacy: The FAA will post all comments it receives, without change, to <http://www.regulations.gov/>, including any personal information the commenter provides. Using the search function of the docket web site, anyone can find and read the electronic form of all comments received into any FAA docket, including the name of the individual sending the comment (or signing the comment for an association, business, labor union, etc.). DOT's complete Privacy Act Statement can be found in the Federal Register published on April 11, 2000 (65 FR 19477-19478), as well as at <http://DocketsInfo.dot.gov/>.

Docket: Background documents or comments received may be read at <http://www.regulations.gov/> at any time. Follow the online instructions for accessing the docket or go to the Docket Operations in Room W12-140 of the West Building Ground Floor at 1200 New Jersey Avenue, SE., Washington, D.C., between 9 a.m. and 5 p.m., Monday through Friday, except federal holidays.

FOR FURTHER INFORMATION CONTACT: Joe Jacobsen, FAA, Airplane and Flightcrew Interface Branch, ANM-111, Transport Airplane Directorate, Aircraft Certification Service,

1601 Lind Avenue SW., Renton, Washington, 98057-3356; telephone 425-227-2011; facsimile 425-227-1149.

SUPPLEMENTARY INFORMATION:

The substance of these special conditions has been subject to the public comment process in several prior instances with no substantive comments received. The FAA therefore finds that good cause exists for making these special conditions effective upon publication in the *Federal Register*.

Comments Invited

We invite interested people to take part in this rulemaking by sending written comments, data, or views. The most helpful comments reference a specific portion of the special conditions, explain the reason for any recommended change, and include supporting data.

We will consider all comments we receive on or before the closing date for comments. We may change these special conditions based on the comments we receive.

Background

On December 10, 2009, Bombardier Inc. applied for a type certificate for their new Models BD-500-1A10 and BD-500-1A11 series airplanes (hereafter collectively referred to as “C-series.” The C-series airplanes are swept-wing monoplanes with a pressurized cabin. They share an identical supplier base and significant common design elements. The fuselage is aluminum alloy material, blended double-bubble fuselage, sized for nominal 5-abreast seating. Each airplane’s powerplant consists of two under wing Pratt and Whitney PW1524G ultra-high bypass, geared turbofan engines. Flight controls are fly-by-wire flight with two passive/uncoupled side sticks. Avionics includes five landscape primary cockpit displays. The

dimension of the airplanes encompass a wingspan of 115 feet; a height of 37.75 feet; and a length of 114.75 feet for the Model BD-500-1A10 and a length of 127 feet for the Model BD-500-1A11. Passenger capacity is designated as 110 for the Model BD-500-1A10 and 125 for the Model BD-500-1A11. Maximum takeoff weight is 131,000 pounds for the Model BD-500-1A10 and 144,000 pounds for the Model BD-500-1A11. Maximum takeoff thrust is 21,000 pounds for the Model BD-500-1A10 and 23,300 pounds for the Model BD-500-1A11. Range is 3,394 miles (5,463 kilometers) for both models of airplanes. Maximum operating altitude is 41,000 feet for both model airplanes.

The Bombardier C-series airplanes will use side stick controllers for pitch and roll control. Regulatory requirements pertaining to conventional wheel and column, such as pilot strength and controllability, are not directly applicable for the side stick. In addition, pilot control authority may be uncertain because the side sticks are not mechanically interconnected as with conventional wheel and column controls.

Type Certification Basis

Under the provisions of Title 14, Code of Federal Regulations (14 CFR) 21.17, Bombardier Inc. must show that the C-series airplanes meet the applicable provisions of 14 CFR part 25 as amended by Amendments 25-1 through 25-129 thereto.

If the Administrator finds that the applicable airworthiness regulations (i.e., 14 CFR part 25) do not contain adequate or appropriate safety standards for the C-series airplanes because of a novel or unusual design feature, special conditions are prescribed under the provisions of § 21.16.

Special conditions are initially applicable to the model for which they are issued. Should the type certificate for that model be amended later to include any other model that incorporates the same or similar novel or unusual design feature, the special conditions would also apply to the other model under § 21.101.

In addition to the applicable airworthiness regulations and special conditions, the C-series airplanes must comply with the fuel vent and exhaust emission requirements of 14 CFR part 34 and the noise certification requirements of 14 CFR part 36, and the FAA must issue a finding of regulatory adequacy under § 611 of Public Law 92-574, the “Noise Control Act of 1972.”

The FAA issues special conditions, as defined in 14 CFR 11.19, in accordance with § 11.38, and they become part of the type-certification basis under § 21.17(a)(2).

Novel or Unusual Design Features

The C-series airplanes will incorporate the following novel or unusual design features: Side stick controllers for pitch and roll control, which are not mechanically interconnected as with conventional wheel and column controls. These airplanes also have a fly-by-wire electronic flight control system. This system provides an electronic interface between the pilot's flight controls and the flight control surfaces for both normal and failure states, and it generates the actual surface commands that provide for stability augmentation and control about all three airplane axes. In addition, pilot control authority may be uncertain, because the side sticks are not mechanically interconnected as with conventional wheel and column controls.

Discussion

Current FAA regulations do not specifically address the use of side stick controllers for pitch and roll control. The unique features of the side stick must therefore be demonstrated through flight and simulator tests to have suitable handling and control characteristics when considering the following:

1. The handling qualities tasks/requirements of the C-series airplanes special conditions and other part 25 stability, control, and maneuverability requirements, including the effects of turbulence.
2. General ergonomics: Arm rest comfort and support, local freedom of movement, displacement angle suitability, and axis harmony.
3. Inadvertent input in turbulence.
4. Inadvertent pitch-roll cross talk.

These requirements are elaborated upon in these special conditions, which contain the additional safety standards that the Administrator considers necessary to establish a level of safety equivalent to that established by the existing airworthiness standards.

The FAA Handling Qualities Rating Method (HQRМ) in Appendix 5 of Advisory Circular 25-7C, *Flight Test Guide for Certification of Transport Category Airplanes*, may be used to show compliance.

Applicability

As discussed above, these special conditions are applicable to the Bombardier Models BD-500-1A10 and BD-500-1A11 series airplanes. Should Bombardier Inc. apply at a later date

for a change to the type certificate to include another model incorporating the same novel or unusual design feature, the special conditions would apply to that model as well.

Conclusion

This action affects only certain novel or unusual design features on two model series of airplanes. It is not a rule of general applicability.

The substance of these special conditions has been subjected to the notice and comment period in several prior instances and has been derived without substantive change from those previously issued. It is unlikely that prior public comment would result in a significant change from the substance contained herein. Therefore, the FAA has determined that prior public notice and comment are unnecessary, and good cause exists for adopting these special conditions upon publication in the Federal Register. The FAA is requesting comments to allow interested persons to submit views that may not have been submitted in response to the prior opportunities for comment described above.

List of Subjects in 14 CFR Part 25

Aircraft, Aviation safety, Reporting and recordkeeping requirements.

The authority citation for these special conditions is as follows:

Authority: 49 U.S.C. 106(g), 40113, 44701, 44702, 44704.

The Special Conditions

Accordingly, pursuant to the authority delegated to me by the Administrator, the following special conditions are issued as part of the type certification basis for the Bombardier Inc. Models BD-500-1A10 and BD-500-1A11 series airplanes.

In the absence of specific requirements for side stick controllers, the following apply:

1. Pilot strength: In lieu of the “strength of pilots” limits shown in § 25.143(c) for pitch and roll, and in lieu of specific pitch force requirement of §§ 25.145(b) and 25.175(d), it must be shown that the temporary and maximum prolonged force levels for the side stick controllers are suitable for all expected operating conditions and configurations, whether normal or non-normal.
2. Pilot control authority: The electronic side stick controller coupling design must provide for corrective and/or overriding control inputs by either pilot with no unsafe characteristics. Annunciation of the controller status must be provided and must not be confusing to the flightcrew.
3. Pilot control: It must be shown by flight tests that the use of side stick controllers does not produce unsuitable pilot-in-the-loop control characteristics when considering precision path control/tasks and turbulence. In addition, pitch and roll control force and displacement sensitivity must be compatible, so that normal inputs on one control axis will not cause significant unintentional inputs on the other.

Issued in Renton, Washington, on December 12, 2013.

John P. Piccola, Jr.,
Acting Manager, Transport Airplane Directorate,
Aircraft Certification Service.

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